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The creation of a digital soil map for Cyprus using decision-tree classification techniques

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Considering the increasing threats soil are experiencing especially in semi-arid, Mediterranean environments like Cyprus (erosion, contamination, sealing and salinisation), producing a high resolution, reliable soil map is essential for further soil conservation studies. This study aims to create a 1:50.000 soil map covering the area under the direct control of the Republic of Cyprus (5.760 km^2).

The study consists of two major steps. The first is the creation of a raster database of predictive variables selected according to the *scorpan* formula (McBratney et al., 2003). It is of particular interest the possibility of using, as soil properties, data coming from three older island-wide soil maps and the recently published geochemical atlas of Cyprus (Cohen et al., 2011). Ten highly characterizing elements were selected and used as predictors in the present study. For the other factors usual variables were used: temperature and aridity index for climate; total loss on ignition, vegetation and forestry types maps for organic matter; the DEM and related relief derivatives (slope, aspect, curvature, landscape units); bedrock, surficial geology and geomorphology (Noller, 2009) for parent material and age; and a sub-watershed map to better bound location related to parent material sources.

In the second step, the digital soil map is created using the Random Forests package in R. Random Forests is a decision tree classification technique where many trees, instead of a single one, are developed and compared to increase the stability and the reliability of the prediction. The model is trained and verified on areas where a 1:25.000 published soil maps obtained from field work is available and then it is applied for predictive mapping to the other areas.

Preliminary results obtained in a small area in the plain around the city of Lefkosia, where eight different soil classes are present, show very good capacities of the method. The Ramdom Forest approach leads to reproduce soil classes with a success percentage included between 88% (calcaric fluvic Cambisols and vertic Cambisols) and 96% (skeletric calcaric Regosols and calcaric lithic Leptosols).

In a parallel study, characteristic profiles are assigned to every soil class. The soil classes will be field checked with mapped and unmapped areas including points with new soil properties.

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